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Interview: Pushpendra Johari

Pushpendra Johari,
Senior VP – Sustainability at RMSI

"There're Many Hydropower Projects Vulnerable to Natural Disasters"

The recent glacier ice avalanche-induced flash flood that occurred on February 7, 2021, is a recent example, which impacted the river channels and hydropower projects located close to the glacier in the downstream area. Although the event damaged Rishi Ganga Hydel Project and Tapovan-Vishnugad Hydropower Project, there are many other hydropower projects which are vulnerable to natural disasters, disclosed Pushpendra Johari, Senior VP – Sustainability, RMSI, in an exclusive conversation with Manu Tayal, Associate Editor, Energetica India. Johari also discussed his company's key findings, and the reasons behind Uttarakhand's Glacier Ice Avalanche, suggestive measures to avoid such events, etc. Here're the edited excerpts

"Kindly shed some light on RMSI, and how it helps utilities in improving operational efficiencies?"

RMSI is a global leader in geospatial and engineering solutions. These solutions address global issues of climate change, natural calamities, human habitation, food security, autonomous transportation, smart utilities, and networks.
In the utility sector, RMSI provides GIS solutions for managing transmission, distribution, and integrity management of utility assets. We help global utilities meet their key challenges of improving operational efficiencies, reducing operational costs, improving asset management, process re-engineering, optimizing capacity, mitigating risks, and meeting regulatory compliance requirements through our proprietary data management, conflation, and migration tools, frameworks, and processes.

"Name a few of the major power sector projects of RMSI?"

RMSI has executed several power sector projects. The key amongst them are:
• RMSI was part of the prestigious Restructured Accelerated Power Development and Reforms Programme (R-APDRP) initiated by the Government of India for establishing reliable and automated systems for sustained collection of accurate baseline data, and adoption of Information Technology for energy accounting. The objective of the program was to cut AT&C losses in India.
As part of a consortium, RMSI won the project implementation of Rajasthan and Maharashtra. The consortium won the bid for supply, installation, integration, testing, commissioning and facility management service covering software, hardware, field survey, and networking. Within the consortium, RMSI acted as the Geospatial Services Provider (GSP) and was responsible for developing a customized GIS enterprise application, base map creation, asset survey, and consumer indexing.
• Assessment of Hydropower Potential of Indian rivers
• Assessment of Climate Risk to Kafue Gorge Lower (KGL) Hydropower Project in Zambia
• We have done several multi-hazard risk assessment projects that include risk assessment of hydropower projects in India, and in several other countries in Africa, Europe, etc.
• We are currently working on the impact of cyclones on electric power in India in general and Odisha

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"In your view, what were the reasons behind Uttarakhand's Glacier Ice Avalanche which severely hit some hydropower projects in the region this year?"

The glacier ice avalanche-induced flash flooding occurred due to the detachment of a large extent of the glacier from its main body. The ice-avalanche, covering approximately 14 sq km area, swept debris from the valley, thus, pushing a large amount of rock, moraines, mud, and debris, and prompting a flood in the Rishi Ganga, Dhauli Ganga, and Alaknanda rivers. The floodwater swept over 100 km down steep through the Ganga tributaries before attaining its normal condition in the channel.
The intense flow of rock and ice can generate tremendous heat, which melts large volumes of ice, leading to a huge water volume that floods rivers in a flash.

"What are your key findings and are there any risks on current hydropower projects in Uttarakhand?"

Hydropower projects located in the Uttarakhand State have a threat from natural hazards such as flash floods due to cloud burst, glacier lake outburst floods (GLOF), landslides, rockslides, avalanches, debris flow, earthquake, etc. Not all hazards would be relevant for all projects as it's a function of the project location. The recent glacier ice avalanche-induced flash flood that occurred on February 7, 2021, is a recent example, which impacted the river channels and hydropower projects located close to the glacier in the downstream area.
Although the event damaged Rishi Ganga Hydel Project and Tapovan-Vishnugad Hydropower Project, there are many other hydropower projects which are vulnerable to natural disasters. The massive flash flood created during the Kedarnath flood event in 2013, is another example, which impacted the number of hydropower projects.
Earthquake risk is relevant to the projects but here also the location of the project makes a difference as an earthquake could induce avalanches, landslides, rockslides that could potentially damage a hydropower project and may result even in a downstream flood if the project has a large reservoir full of water.

"How many major hydropower projects are present (either commissioned or under construction) in Uttarakhand? How much time and investment required in setting up such projects?"

The availability of water and topography of Uttarakhand State creates a huge hydropower potential. In particular, the Bhagirathi and Alaknanda rivers of the State are highly rich in terms of hydropower potential. There are several large hydropower projects, such as Tehri, which have been commissioned and is generating power. At the same time, a number of hydropower projects are under different stages of development.

For having an idea of the total cost of these projects, one can consider about Rs 7-8 crore per MW. Planning, designing, construction, and commission of large hydropower projects including approval and clearances from the government varies from about 5 to 10 years.

List of important projects existing and under different stages of development in Uttarakhand

1 LataTapovan Project of 171 MW on Dhauli Ganga River
2 TapovanVishnugad Project of 520 MW on Dhauli Ganga River
3 Vishnuprayag Project of 400 MW on Alaknanda River
4 Srinagar Project of 330 MW on Alaknanda River
5 KotliBhel Project of 320 MW on Alaknanda River
6 Tehri Project of 1000 MW on Bhagirathi River
7 Koteshwar Project of 400 MW on Bhagirathi River
8 Tehri Stage-II Project of 1000 MW on Bhagirathi River
9 VishnugadPipalkoti Project of 444 MW on Alaknanda River
10 Naitwar Mori Project of 60 MW on Tons River
11 PhataByumg Project of 76 MW on Mandkani River
12 SingoliBhatwari Project of 99 MW on Mandakani River
13 ManeriBhali-I Project of 90 MW on Bhagirathi River
14 ManeriBahli-II Project of 304 MW on Bhagirathi River
15 Chibro Project of 240 MW on Yamuna River
16 Khodri Project of 120 MW on Yamuna River
17 Ramganga Project of 198 MW on Ramganga River
18 Dhauliganga Project of 280 MW on Sharda River
19 Tanakpur Project of 94.2 MW on Sharda River
20 Khatima Project of 41.4 MW on Sharda River

“What kind of mitigation measures should be initiated to minimize the impact of such kinds of events in the future on hydropower projects and other infrastructure?”

Several hazards including floods, earthquakes, avalanches, drought, and landslides impact structures in their path in different ways. Below are the mitigation strategies that can be adopted for each type of hazard to avoid such events in the future.

o For avalanches: Snow Supporting Structures

- Supporting structures such as supporting steel bridges and snow nets
- Deflecting and catching dams are earth darns, sometimes combined with stone masonry, can increase the slope-inclination at the impact side
- Mountain Forest

o Rock Falls:

- Slope ditches to absorb falling rocks
- Earth dams
- Barriers and wire net systems

o For landslides: Slope retaining structures

- Modification of slope geometry by reducing the general slope angle and trimming of loose surface material, removing material from the upper area and substituting it with lightweight fill, or construction of a buttress berm or fill at the toe
- Retaining structures like reinforced earth retaining structures or concrete walls, passive piles, crib block walls, etc.
- Internal slope reinforcement through rock bolts and soil nailing, anchors, micro-piles and anchored piles or grouting and jetting
- Improving drainage as water flow is one of the main reasons leading to landslides by:

*Surface drains to divert run-off water from flowing onto the slide area, by collecting ditches, mortar, or steel channels.

*Shallow or deep trench drains (depth of 5 - 15 m) with pipes, filled with free-draining geo-materials, i.e., coarse granular fills protected by geo-synthetics

*Vertical small-diameter boreholes with pumping or vacuum dewatering, siphoning, or self-draining into an underlying pervious rock layer

*Vertical large diameter wells filled with coarse material, with gravity draining at the toe by a horizontal borehole or a gallery.

o For Impulse waves

- Waves induced by large masses moving into water are called impulse waves. These could happen because of a large sheet of ice or rock falling into a reservoir and its impact can be controlled by bottom outlets in reservoirs

o For Floods:

- Check dams, levees
- Flood retention pond/floodwalls

o Debris flow:

- Building a series of concrete dams of limited height, in the stream beds with debris flow potential
- Construction of lateral dams or dikes along the stream bed
- Emergency spillway structure before the dam to divert the flow
- Structure separating bedload from water - large open reinforced concrete structure built below the riverbed and covered by a steel ruck with large spacing between the bars, like a large sieve

o Wind and earthquake resistant structure design

- Cross bracing, shock absorbers, shear walls

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